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5J26 MAGNETRON MTI STUDY

Quarterly Progress Report No. 3

Department of the Navy
Bureau of Ships
Contract No. NObsr-63356
Index No. [illegible]

TUBE DEPARTMENT

GENERAL ELECTRIC

SCHENECTADY, NEW YORK

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INDUSTRIAL AND TRANSMITTING TUBE SUB-DEPARTMENT

OF THE

GENERAL ELECTRIC COMPANY

SCHENECTADY, N.Y.

THIRD QUARTERLY TECHNICAL REPORT

ON

5J26 MTI STUDY

CONTRACT NObsr 63356

INDEX NO. NE-110340 St. 23

OCTOBER 1, 1953 to JANUARY 1, 1954

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Third Quarterly Report on

5J26 MTI Study

April 13, 1954

Period Covered: October 1, 1953 to
January 1, 1954

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Contract No. - NObsr-63356

Index No. NE-110340 St. 23

A. Abstract

Some 5J26 magnetrons have been operated in the test modulator. Test equipment construction has been delayed.

B. Purpose

To study and evaluate the possibility for development of a suitable replacement for the 5J26 to insure availability of a microwave L-band power oscillator capable of reliable performance in MTI applications.

C. General Factual Data

Preliminary testing of magnetrons was started. Difficulties were encountered with both the modulator and the magnetrons.

The 1-5/8" coaxial water load performed satisfactorily at the power levels developed so far.

A Bird termaline coaxial resistor was measured for its VSWR and was tested at the power levels available.

Test equipment being made in the Development Shop has been delayed.

Approval of our proposal for modification of the modulator has been received.

No magnetrons have been received from Naval sources.

D. Detailed Factual Data

Much of the effort in the last month has been directed at firing up of the modulator to commence testing. The difficulties encountered will be discussed below, though some might more properly be treated under equipment.

The modulator, constructed for use on contract NObsr 42170, was previously used as a power source at 1 μ sec pulse length for design testing of TR and ATR tubes.

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It was moved to this group's testing area, and after preliminary modification of the circuits, magnetron mount, etc., was operated with magnetron #1 using the 1-5/8" x 5/8" x 1" coaxial water load previously developed for this purpose.

For the sake of clarity, it is best at this point to discuss the magnetrons used. Magnetron #1 was obtained from the General Electric Company Research Laboratory, where, after adequate life, it had failed to operate satisfactorily (low power output, high arc rate). Magnetrons #2 and #3 were obtained from Scranton Tube Works of General Electric Company. These two magnetrons are known to be at least two years old, and may possibly be World War II surplus magnetrons. The latter two magnetrons came under General Electric control when a production facilities contract was transferred from Sarkes-Tarzian to General Electric.

As in the first week of December, only magnetron #1 was available, the system was operated knowing that poor results would be obtained. The first difficulty encountered was traced to a faulty filament under-current protection relay. The circuit was temporarily rewired to permit operation pending receipt of a replacement relay.

As pulses were applied extreme ripple conditions were encountered in the charging voltage wave form, which were traced to improper reconnection of the modulator to the 3-phase supply system after its movement. Proper connection reduced the ripple, but it still had an objectionally higher value. This was reduced to a satisfactory level by increasing the charging voltage power supply output condenser from its previous value of 0.5 mfd to 0.5 mfd. Using a three micro-second pulse length, and hence a large value of pulse line capacitance, it was found by energy considerations that 1/2 the energy on the power supply capacitor was being removed every time the pulse line charged (neglecting the energy contributed by the power supply diodes with only 0.5 mfd. capacitor).

Operation continued, but a stable average current values above 10 ma. (.001 duty cycle) could not be obtained.

Magnetrons #2 and #3 were then received. Magnetron #2 was operated first. It gave very unstable performance, and could not be driven to rated operating conditions after 20 hours of aging operation. At this point, it developed an intermittent open heater, and was removed from the modulator.

Tube #3 was then placed in the modulator and operated. After 32 hours of operation, it could only be driven to 32 ma average current (rated current 46 to 55 ma depending on type of operation) but was still improving. This tube is still being aged and it has permitted certain adjustments and corrections to be made to the modulator. It is also the only tube available at present.

Extraneous pickup was experienced on both the current and voltage waveforms. This was reduced to a low level by redressing all leads, and providing low impedance (200 to 400 ohm) terminations for all cables.

The large amount of RF power radiation from the cathode was shown by the ability to light a neon bulb almost anywhere in the modulator cabinet, at this power level (about 2/3 of normal).

The 1-5/8" x 5/8" x 1" load gave no indication of breakdown at this power level (about 300-400 KW). A Litton 1-5/8" U-line and stub also were found to perform satisfactorily at these power levels. The stub is operated to produce a VSWR of 1.13 to give a combined load and stub VSWR of less than 1.05 over the 5J26 band (1220 to 1350 mc). At this low VSWR (1.13), the dielectric of the stub is no closer than 1/16" to the center conductor of the line.

A Bird termiline resistor #81 was supplied by Scranton Tube Works. It is rated at 2,000 watts average dissipation. Its VSWR over the desired frequency band was measured. (See Figure #1). It operated satisfactorily at 25 ma. average magnetron current, but seems to increase the instability of the magnetron at 32 ma. average. Since this load must be operated vertically, a 90° bend (Andrews Corp.) had to be used. It is possible that the dielectric supports in this section may have been breaking down.

Approval for modification of the modulator was received on December 5, 1953.

The eleven magnetrons requested from Naval sources on September 28, 1953 have not yet been received. The effect of the absence of satisfactory 5J26's on our testing program is quite apparent.

Because of the above delay, an extension of contract completion date will be requested. This will be submitted in the month of January 1954.

The following engineering personnel worked the indicated hours.

RE Johnson	196 1/2 hours
TR Bristol	20 hours
Total	216 1/2 hours

Expenditures previously reported	$15,345
Expenditures this month (December)	1,814
Total expended to date	$17,159

E. Equipment

The special test equipment ordered from our development shop has not yet been received. Delivery has been promised to start by January 15, 1954.

Two of the ten crystals for the crystal multiplier chain have been received.

F. Conclusion

Using several faulty magnetrons, preliminary operation of the test modulator has been accomplished. Test equipment construction has been started. Unavailability of satisfactory magnetrons is interfering with the initiation of the testing program.

G. Objectives for next interval.

I To continue liasion with equipment manufacturers.

II To continue systems analysis.

III To complete construction of test equipment.

IV Upon receipt of satisfactory sample 5J26 tubes, to start testing and evaluation.

Richard E Johnson

Richard E. Johnson
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Electronics Division
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Schenectady, New York

Countersigned by:

T.P. Curtis

T.P. Curtis

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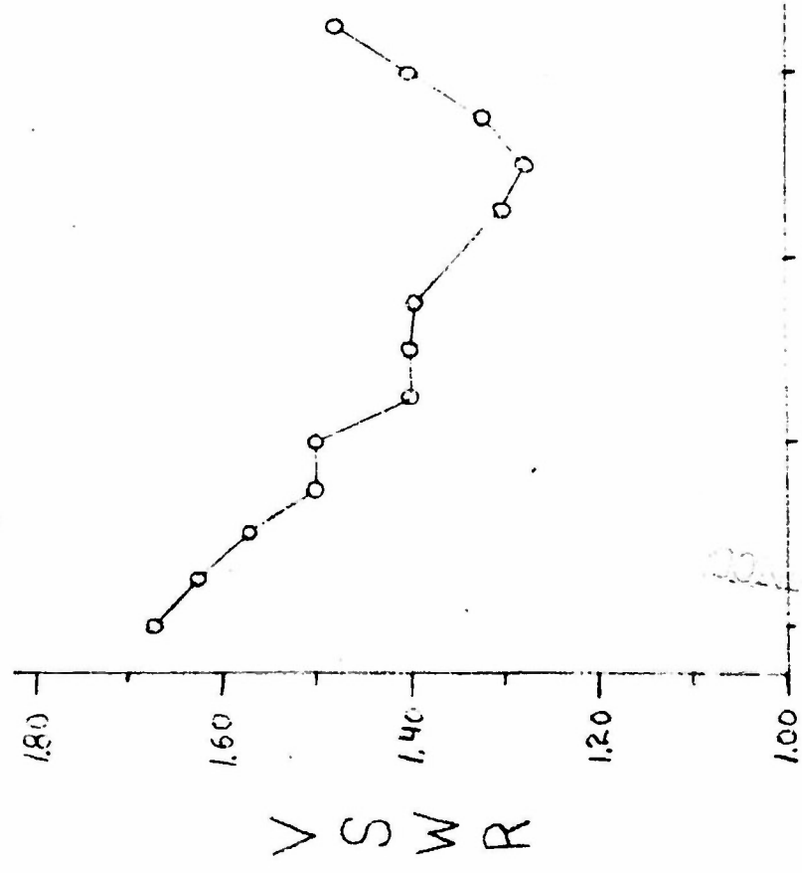
	FIRST MADE FOR		

REVISIONS

BIRD TERMILINE RESISTOR #81 (2 KW MAX CW)



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